NASA's Aeronautics Technology Program Update to ATAC Aeronautics Technology Subcommittee

February 4, 2004

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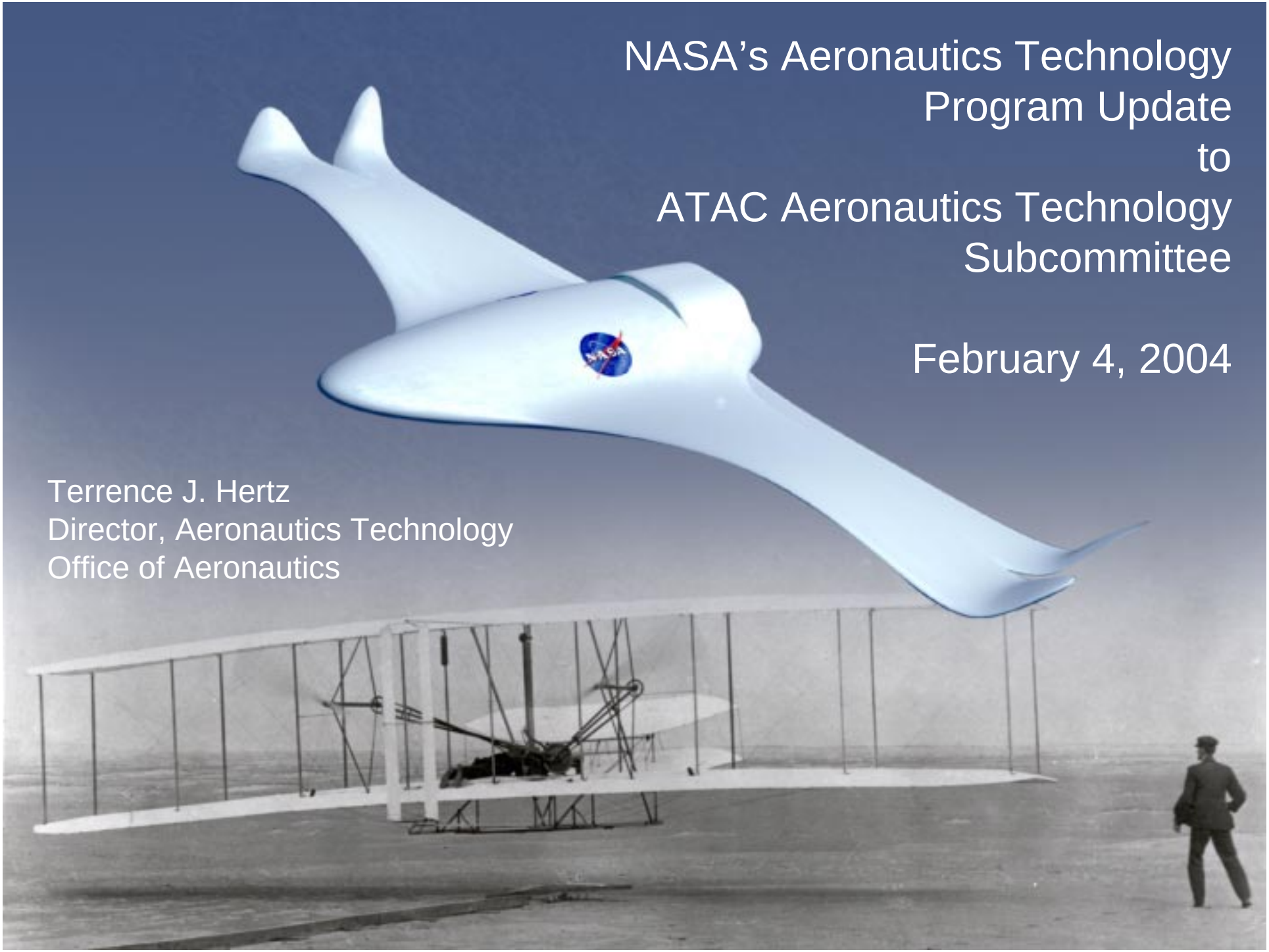
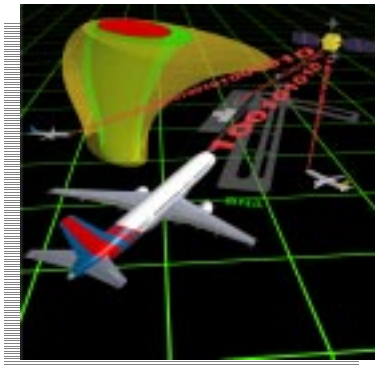
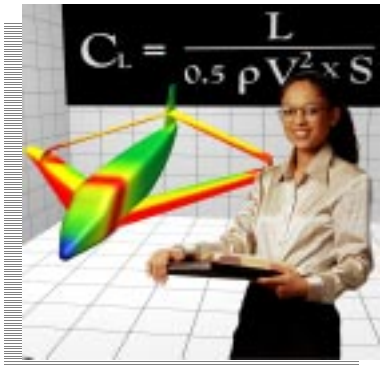


Outline

- Strategy
- Programs
- FY 04 Congressional Appropriation
- FY 05 President's Budget
- FY 06 Proposed Augmentations

The NASA Aeronautics Blueprint



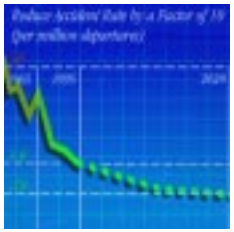


Toward a Bold New Era of Aviation

Electronic copy available: www.aerospace.nasa.gov

Aeronautics Technology Theme Objectives

FY 2004 Strategic Plan



Protect Air Travelers and the Public

Decrease the aircraft fatal accident rate, reduce the vulnerability of the air transportation system to hostile threats, and mitigate the consequences of accidents and hostile acts.

Protect the Environment

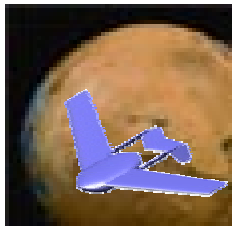
Protect local and global environmental quality by reducing aircraft noise and emissions.

Increase Mobility

Enable more people and goods to travel faster and farther, with fewer delays.

Partnership for National Security

Enhance the Nation's security through [aeronautical] partnerships with DoD, DHS, and other U.S. or international government agencies.



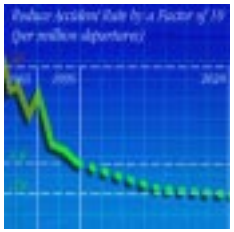
Explore Revolutionary Aeronautical Concepts

Pioneer novel aeronautical concepts and technologies to support science missions and terrestrial and space applications.

Aeronautics Technology Theme Objectives

FY 2004 Strategic Plan — Near-Term Target Metrics

Aeronautics Technology



Protect Air Travelers and the Public

By 2005, enable a reduction of the aviation fatal accident rate by 50% from the FY 1991 - 1996 average

By 2009, enable a reduction in the vulnerability exposure of aircraft and other components in the air transportation system

By 2012, facilitate the near real-time identification and resolution of risks and vulnerabilities in the air transportation system

Protect the Environment

By 2007, enable a reduction in community noise due to aircraft by half, based on the 1997 state of the art

By 2007 enable a reduction of NOx emissions by 70% from the 1996 International Civil Aviation Organization (ICAO) standard

By 2007, enable a reduction in carbon dioxide greenhouse gas emissions by 25 percent based on the 2000 state of the art

Increase Mobility

By 2004, enable a 35 % increase in aviation system throughput in the terminal area and a 20% increase in aviation system throughput based on 1997 National Airspace System capacities

By 2005, provide key enabling capabilities for a small aircraft transportation system

By 2009, enable a further 5 percent increase in throughput in the terminal area and a further 10 percent increase in en route throughput based on 1997 NASA capacity

Enable short-field take-off and landing while maintaining the capability for high-speed cruise

Partnership for National Security

Transfer technology both to and from the Department of Defense

Reduce the vulnerability of the air transportation system in partnership with Department of Homeland Security and Transportation Security Agency

Explore Revolutionary Aeronautical Concepts

By 2008, enable routine operations in the NAS above 18,000 feet for high-altitude, long endurance UAVs

Enable solar-powered vehicles to serve as suborbital satellites for science missions

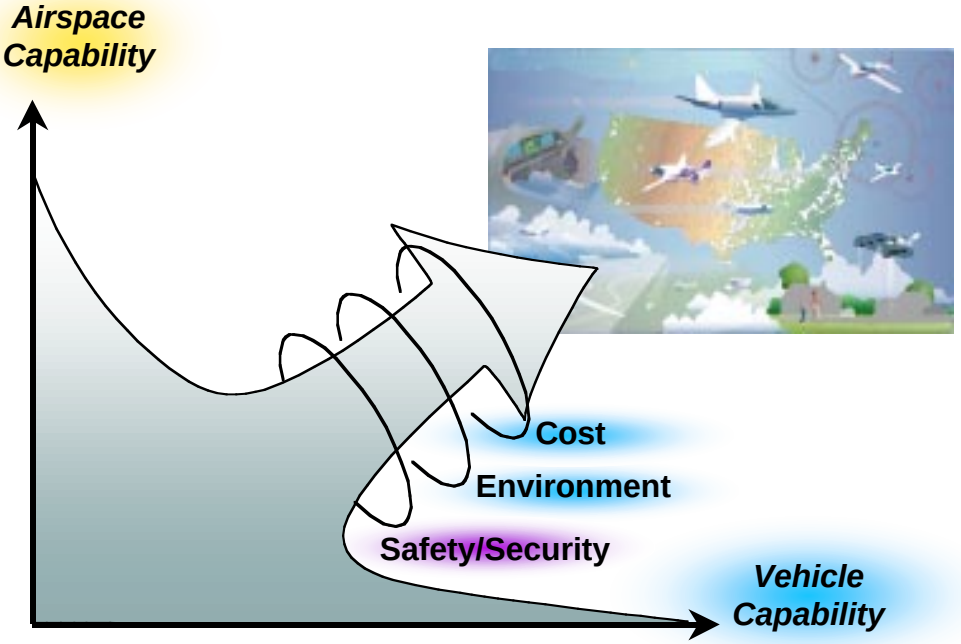
Aerospace Technology Strategic Plan

November 1, 2003

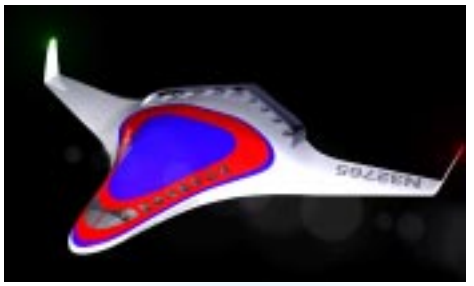
Aeronautics Technology

Three Integrated Programs

Airspace Systems



Aviation Safety & Security



Vehicle Systems

Airspace Systems

Goal:

Enable major increases in the capacity and mobility of the air transportation system through development of revolutionary concepts for operations & vehicle systems

Objectives:

- Improve throughput, predictability, flexibility, collaboration, efficiency, and access of the NAS
  - Enable general aviation and runway-independent aircraft operations
- Maintain system safety, security and environmental protection
- Enable modeling and simulation of air transportation operations

Airspace Systems

Strategic Technical Focus Areas

Efficient Traffic Flow — Improving the efficiency of individual aircraft operating within the National Airspace System (NAS)

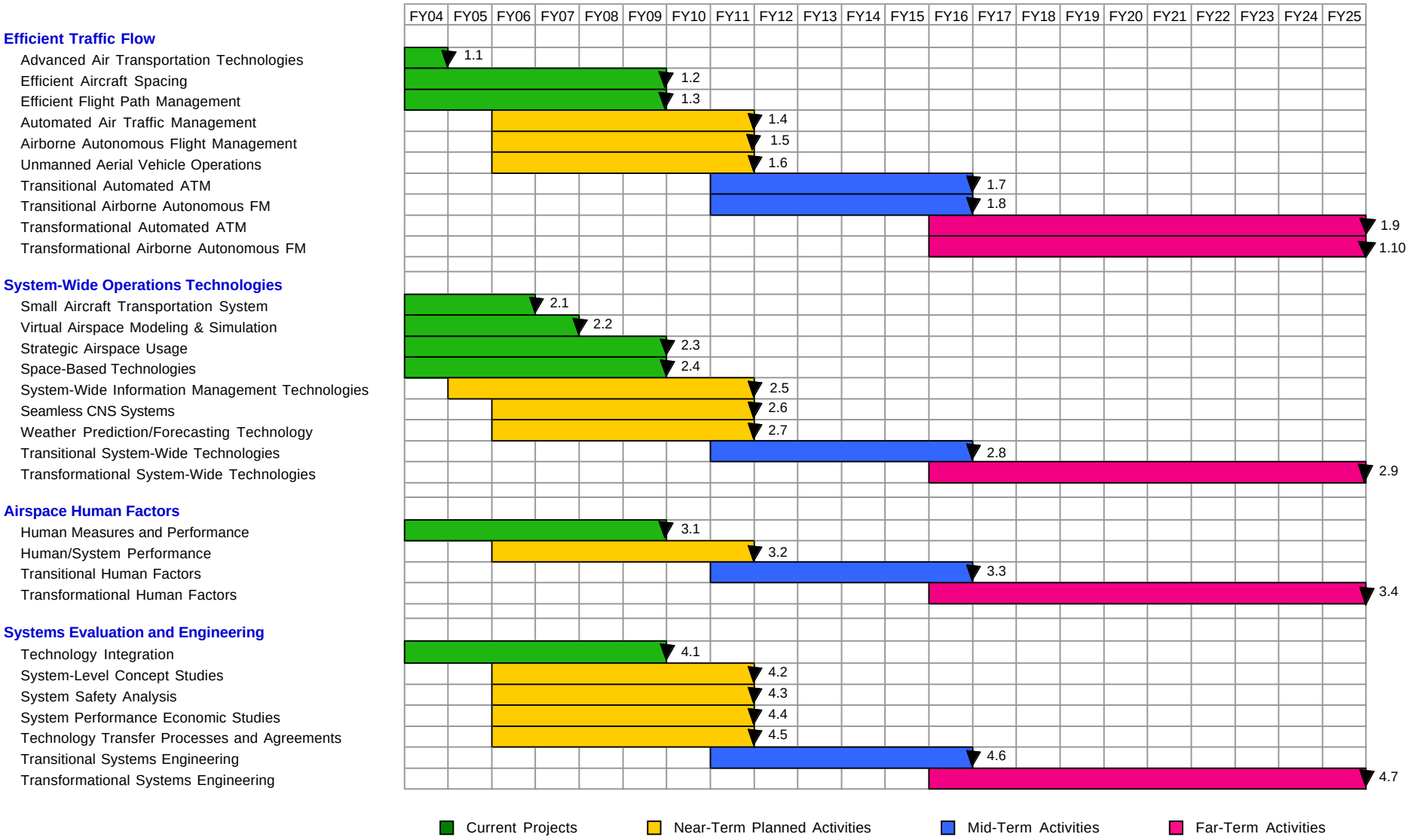
System – Wide Operations Technologies — Efficient operation of the NAS as an overall Nation-wide system with global interaction

Airspace Human Factors — Human interaction, performance and reliability in the design of complex airspace systems

Airspace Systems

Baseline Roadmap

Aeronautics Technology



Aviation Safety & Security Program

Goal:

Decrease the aircraft fatal accident rate and the vulnerability of the air transportation system to threats and mitigate the consequences of accidents and hostile acts

Objectives:

- Develop and demonstrate technologies that reduce aircraft accident rates and reduce aviation injuries and fatalities when accidents do occur
- Develop technologies that reduce the vulnerability of the National Airspace System to terrorist attacks while dramatically improving efficiency of security
- Transfer these advanced concepts, technologies and procedures through a partnership with the Federal Aviation Administration (FAA) and the Transportation Security Administration (TSA) in cooperation with the U.S. aeronautics industry

Aviation Safety & Security

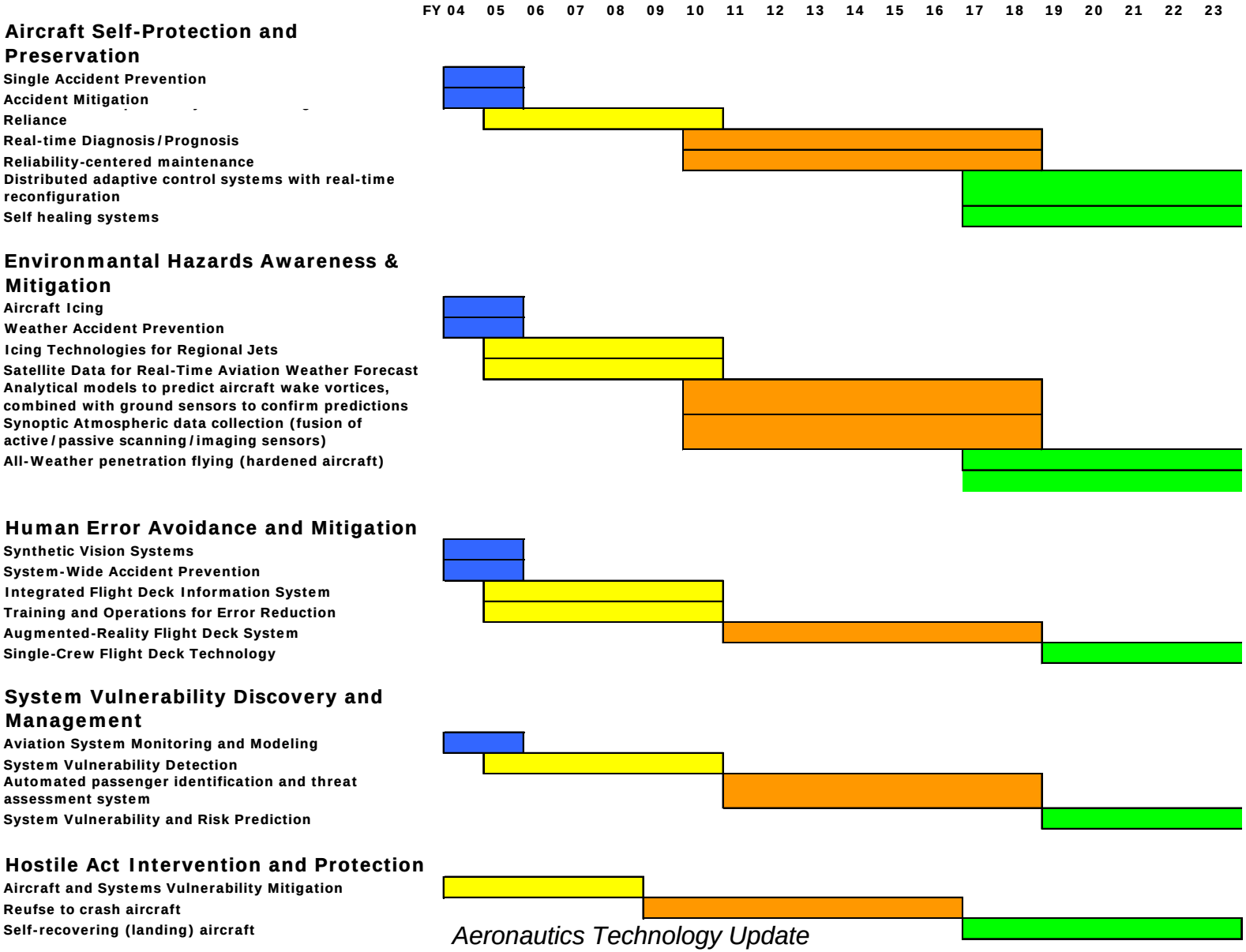
Strategic Technical Focus Areas

- Aircraft Self-Protection & Preservation
  - Protect and prevent damage to aircraft due to abnormal operations and system failures through advances in airborne-based technologies
- Hostile Act Intervention & Protection
  - Increase resiliency of the air traffic system against threats and hostile acts by providing technologies to identify and mitigate potential vulnerabilities
- Human Error Avoidance & Mitigation
  - Prevent unsafe flight situations due to breakdown between human and machine interface and promote optimal flight-crew performance, workload allocation, and situational awareness
- Environmental Hazards Awareness & Mitigation
  - Detect and/or eliminate the effects of natural hazards that could compromise safe ATS operation by reducing the role of atmospheric conditions in aviation fatal accidents, incidents, and injuries
- System Vulnerability Discovery & Management
  - Focus: Identify and inform users of potential ATS vulnerabilities by providing a system-wide safety-risk assessment capability that is accessible to and actively utilized by key stakeholders in the ATS

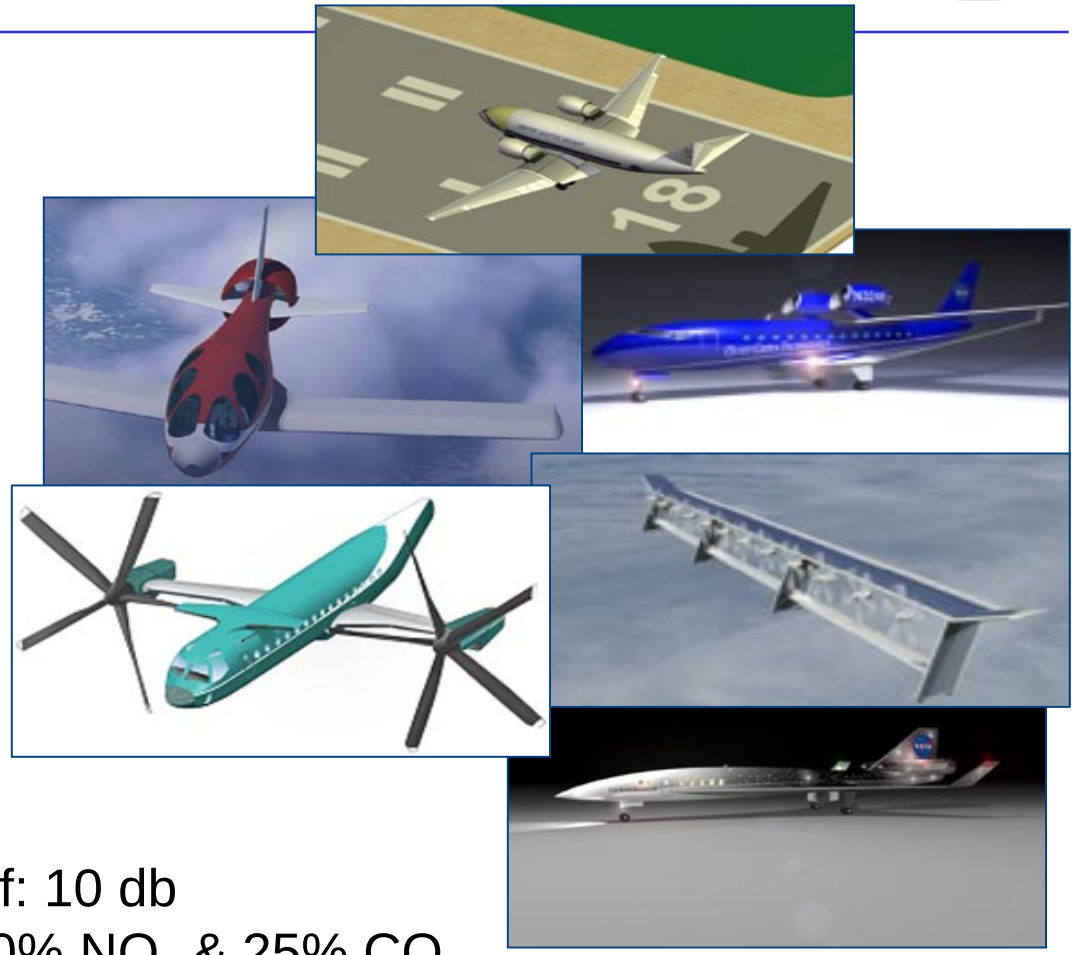
Aviation Safety & Security

Baseline Roadmap

Aeronautics Technology



Vehicle Systems



Goal:

Enable key vehicle capabilities to fulfill the needs of the future air transportation system

Objectives:

- Reduce aviation noise by half: 10 db
- Reduce engine emissions: 70% NO_x & 25% CO_2
- Increase public mobility: more people to more places in less time
- Enable new aeronautical missions for Earth and planetary science
- Develop partnerships to leverage and enhance National aviation capabilities

Vehicle Systems

Strategic Technical Focus Areas

- Environmentally Friendly, Clean Burning Engines
  - Develop innovative technologies to enable intelligent turbine engines with significantly reduced harmful emissions while maintaining high performance and increasing reliability
- New Aircraft Energy Sources and Management
  - Investigate new energy sources and intelligent management techniques for zero emissions and enable new vehicle concepts for public mobility and new science missions
- Quiet Aircraft for Community Friendly Service
  - Develop airframe and engine noise reduction technology and operational concepts to bring objectionable noise within the airport boundary
- Aerodynamic Performance for Fuel Efficiency and Community Access
  - Improve aerodynamic efficiency, structures and materials technologies, and design tools and methodologies to reduce fuel burn and minimize environmental impact and enable new vehicle concepts and capabilities for public mobility and new science missions

Vehicle Systems

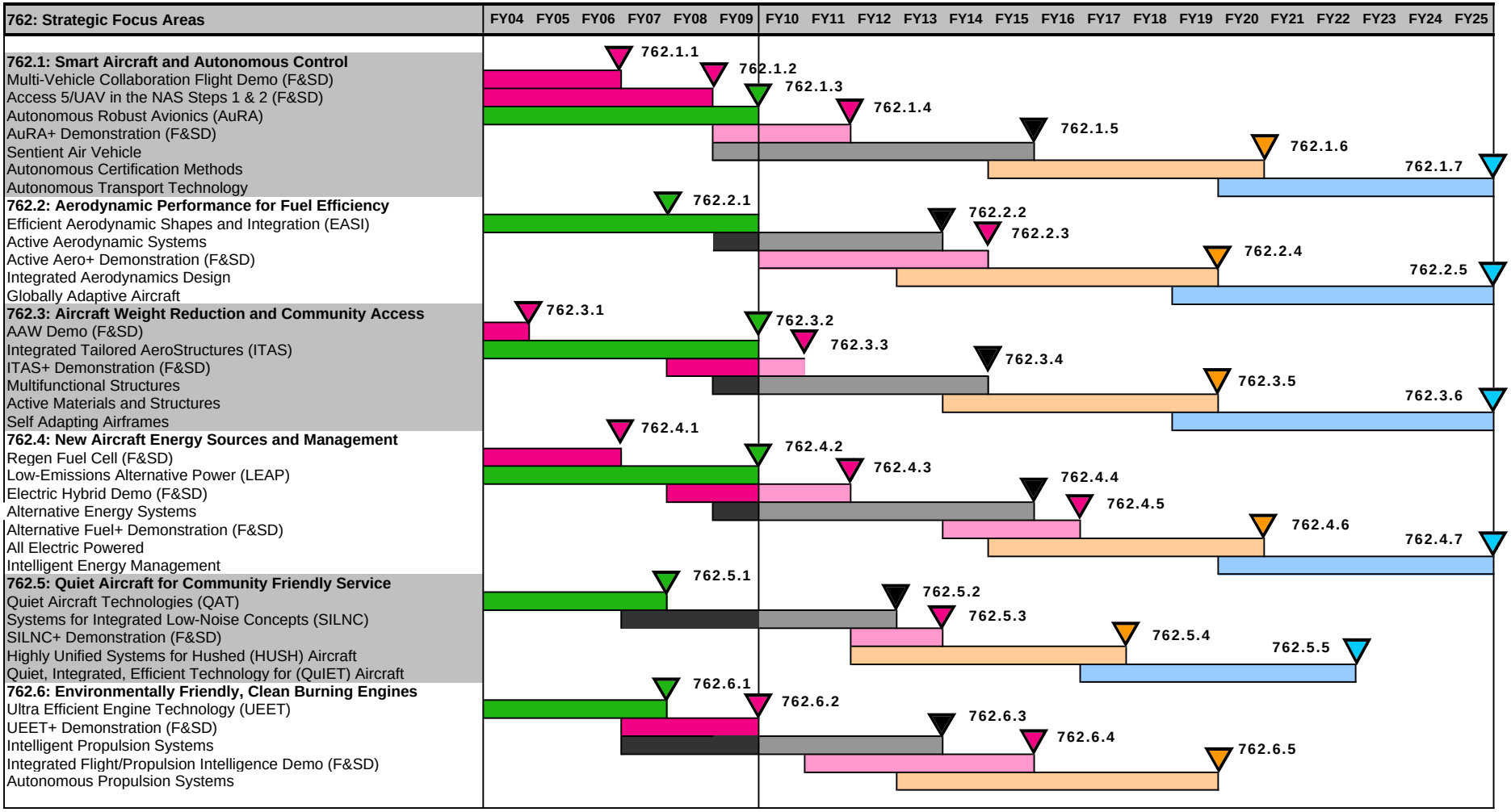
Strategic Technical Focus Areas (cont.)

- Aircraft Weight Reduction and Durability
  - Develop ultralight smart materials and structures, aerodynamic concepts, and lightweight subsystems to enable advanced configurations for public mobility, high altitude long endurance vehicles, and planetary aircraft
- Smart Aircraft and Autonomous Control
  - Enable aircraft to fly with reduced or no human intervention, to optimize flight over multiple regimes, and to provide maintenance on demand towards the goal of a feeling, seeing, sensing, sentient air vehicle
- Flight and System Demonstrations
  - Mature and validate new aircraft capabilities in relevant flight environment in partnership with industry and other government agencies
- Strategic Technical Directions
  - Gather data and perform strategic analysis to provide guidance on future program directions

Vehicle Systems

Baseline Roadmap

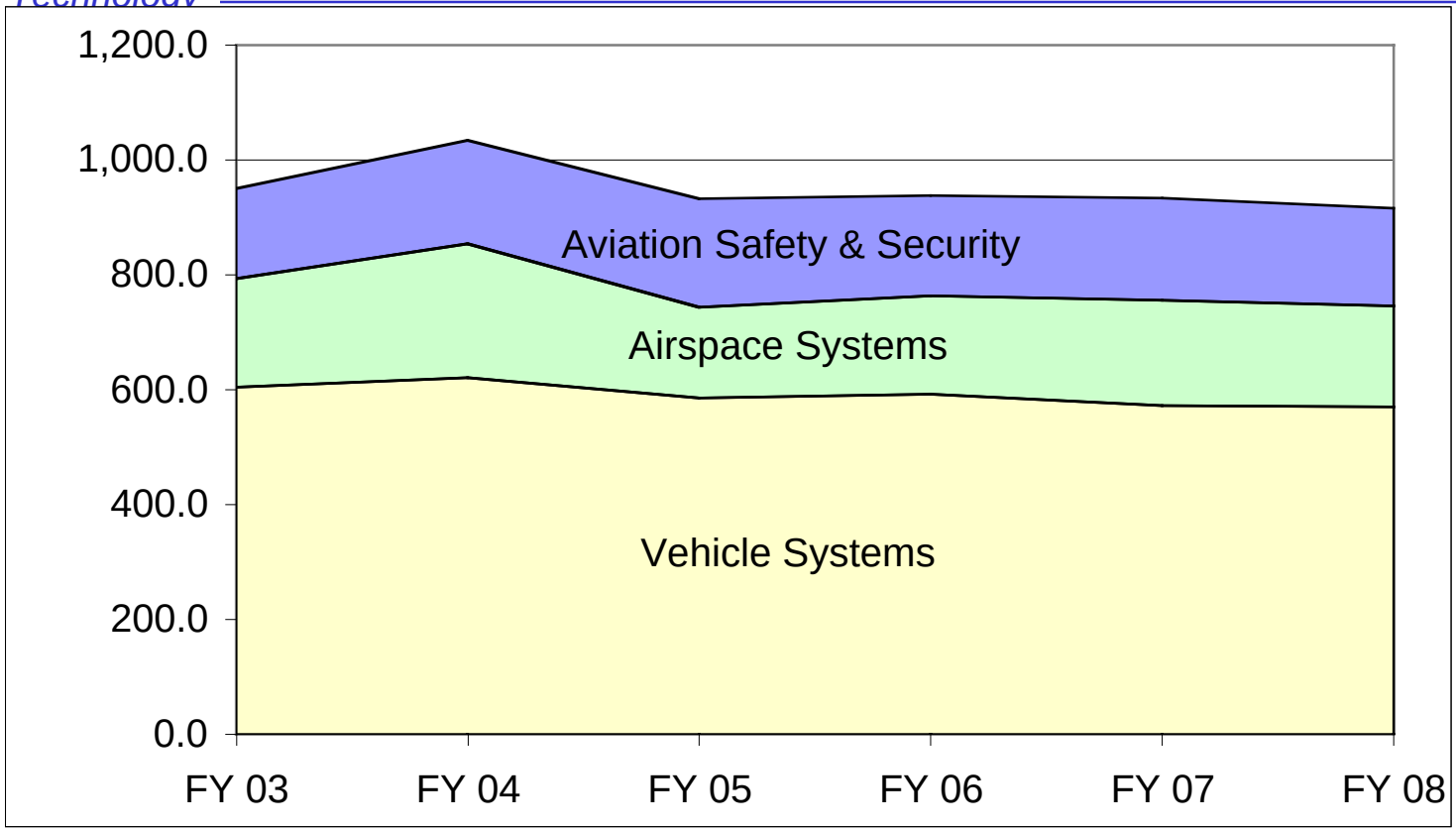
Aeronautics Technology



Notes: Numbered milestones (e.g., ▼3.3) are keyed to elements in the technologies-to-capability matrix.
Not all milestones appear in the technologies-to-capability matrix – some projects support successor projects.

Aeronautics Technology

Budget – FY 04 Congressional Appropriation



	BAU	Full Cost					
	FY 03	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08
Aeronautics Technology	**541.4**	**949.2**	**1,034.3**	**932.2**	**938.7**	**933.8**	**916.4**
Aviation Safety & Security	95.0	156.2	180.0	188.4	175.2	178.2	170.9
Airspace Systems	125.1	188.4	233.9	158.0	172.1	183.9	176.0
Vehicle Systems	321.3	604.6	620.4	585.8	591.4	571.7	569.5

* Business As Usual (BAU) FY 03 reflects estimated Full Cost

Aeronautics Technology

FY 04 Congressional Appropriation by Project

Aeronautics Technology

($ Millions) As of: 1/30/04

OFFICE OF AEROSPACE TECHNOLOGY	FY 03 BAU Mod Op Plan	FY 03*	FY 04	FY 05	FY 06	FY 07	FY 08
###	599.1	1,006.8	959.1	932.2	938.7	933.8	916.4
Aviation Safety & Security	**93.6**	**154.8**	**180.0**	**188.4**	**175.3**	**178.2**	**170.9**
Vehicle Safety Technologies	50.0	83.4	75.7	81.5	-	-	-
System Safety Technologies	23.7	31.0	30.8	20.7	-	-	-
Weather Safety Technologies	19.9	40.4	45.0	42.5	-	-	-
Integrated Intelligent & Intuitive Safety Technologies & Sys	-	-	-	-	117.6	119.8	126.2
Aviation Security Technologies	-	-	28.5	43.7	57.7	58.4	44.7
Vehicle Systems	359.9	**643.5**	**620.4**	**585.8**	**591.4**	**571.7**	**569.5**
Quiet Aircraft Technology (QAT)	19.2	40.6	64.8	71.0	74.0	25.0	-
21st Century Aircraft Technology (TCAT)	26.7	44.8	66.6	42.5	42.1	-	-
Flight Research	58.1	90.6	86.4	43.3	10.5	-	-
ERAST	[19.9]	[23.3]					
Advanced Vehicle Concepts	48.5	86.3	31.9	49.7	-	-	-
Hyper-X	[26.8]	[47.3]					
Breakthrough Vehicle Technologies	56.8	117.3	122.6	115.9	143.1	-	-
Ultra-Efficient Engine Technology (UEET)	67.0	104.8	91.9	88.1	91.0	-	-
[Dual Spool Turbine Test Facility, CoF]	[4.9]	[4.9]	[7.0]				
Propulsion & Power	83.6	159.1	147.5	125.1	31.0	-	-
Flight & System Demonstration			8.7				
Clean Adaptive Vehicle Systems	-	-	-	50.3	199.7	546.7	569.5
Airspace Systems	**145.3**	**208.6**	**233.9**	**158.0**	**172.1**	**183.9**	**176.0**
Advanced Air Transportation Technology (AATT)	82.5	114.4	104.9	-	-	-	-
Small Aircraft Transportation System (SATS)	26.8	36.0	31.5	9.9	-	-	-
Virtual Airspace Modeling & Simulation (VAMS)	25.6	37.9	33.1	33.0	35.0	34.0	-
Aviation Operations Systems	10.4	20.3	20.5	19.3	12.3	-	-
NASA Exploratory Technologies for the NAS (NExTNAS)	-	-	43.9	95.8	124.8	149.9	176.0

* Business As Usual (BAU) FY 03 reflects estimated Full Cost

Aeronautics Technology

FY 04 Congressional Appropriation Earmarks

$12.5M – Aviation Safety & Security

- 4.0M – Adaptive Surveillance Techniques for Airport Surface Safety
- 7.5M – Future aviation system including priority on aviation security & air traffic management
- 1.0M – Wichita State U for Critical Aircraft Icing project

$24.3M – Airspace Systems

- 0.3M – National Communications, Navigation & Surveillance test bed
- 0.5M – Aircraft Radio Guidance System
- 2.0M – To research Secure Automatic Dependent Surveillance Broadcast Surveillance data link technology for enhanced aviation
- 1.0M – Michigan SATS Incorporated
- 5.0M – SOCRATES
- 7.5M – Future aviation sys including priority on aviation security & air traffic mgmt
- 8.0M – Fully fund Virtual Airspace Modeling & Simulation Program and include $8M for Display Systems Replacement

Aeronautics Technology

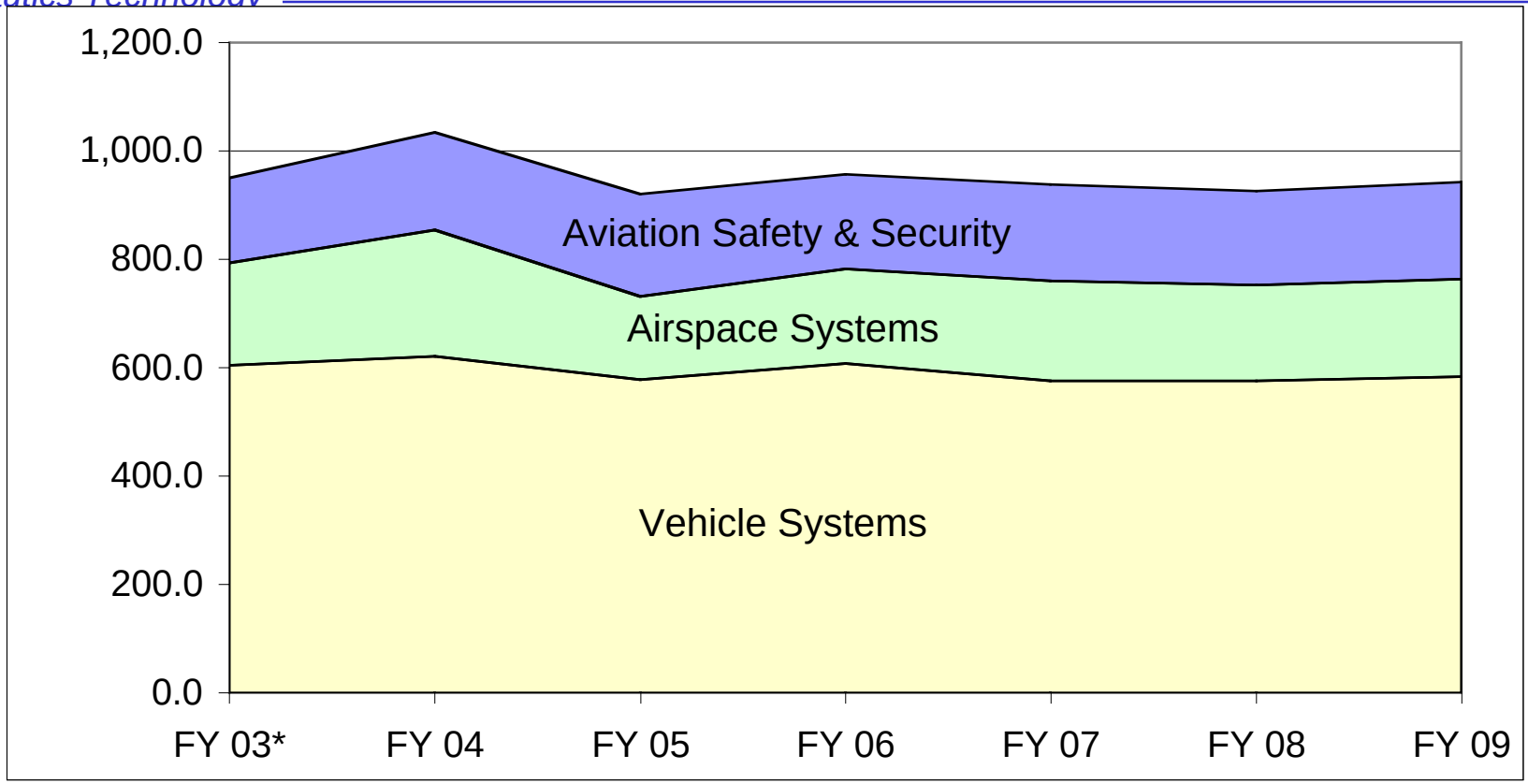
FY 04 Congressional Appropriation Earmarks

$50.7M – Vehicle Systems

- 1.0M – Aircraft engine research, including research being done in conjunction with DoD
- 1.3M – U Toledo Turbine Institute
- 1.5M – DFRC's Intelligent Flight Control System research project
- 0.9M – Florida Institute for Technology for Hydrogen Production, Fuel Cell and Sensor Technology Initiative
- 0.8M – Florida State University System Hydrogen Research Initiative
- 5.0M – Development of Aeronautics Research budget for next 5 years allocated to NASA Institute for Aerospace for contracting with industry & academia
- 3.0M – Wichita State U National Cntr. for Composite Materials Performance
- 15.0M – Future aircraft research with priority on supersonic flight technologies
- 15.0M – Continued development of flight technologies with application to military vehicles

Aeronautics Technology

Budget – FY 05 President's Budget Submit



	BAU	Full Cost						
	FY 03	FY 03*	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
Aeronautics Technology	**541.4**	**949.2**	**1,034.3**	**919.2**	**956.7**	**937.8**	**925.7**	**941.9**
Aviation Safety & Security	95.0	156.2	180.0	188.0	175.1	178.0	173.7	179.2
Airspace Systems	125.1	188.4	233.9	154.4	175.2	183.6	176.7	179.8
Vehicle Systems	321.3	604.6	620.4	576.8	606.4	576.2	575.3	582.9

* Business As Usual (BAU) FY 03 reflects estimated Full Cost

Aeronautics Technology

FY 05 President's Budget Submit by Project

Aeronautics Technology

As Of February 2, 2004

($ Millions)	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
Theme: Aeronautics Technology	**1,034.3**	**919.2**	**956.7**	**937.8**	**925.7**	**941.9**
Aviation Safety & Security Program	**180.0**	**188.0**	**175.1**	**178.0**	**173.7**	**179.2**
Vehicle Safety Technologies	75.7	77.8	-	-	-	-
System Safety Technologies	30.8	21.4	-	-	-	-
Weather Safety Technologies	45.0	44.3	-	-	-	-
Aircraft & Systems Vulnerability Mitigation	24.9	35.5	50.2	49.4	37.1	39.1
Aircraft & Propulsion Systems Self Diagnosis and Self-Reliance	-	-	37.6	36.8	38.4	42.2
Training & Operations for Error Reduction	-	-	8.8	9.6	9.6	9.6
Icing Technology for Regional Jets	-	-	8.1	9.0	10.0	9.5
Satellite Data for Real-time Aviation Weather Forecast	-	-	9.9	10.3	11.2	13.0
Technical Integration	2.0	3.3	14.7	16.7	11.7	12.7
Integrated Presentation of Safety Critical Flight Information	-	-	27.6	27.5	37.3	32.9
System Vulnerability Detection	1.6	5.7	18.2	18.7	18.4	20.2
Vehicle Systems Program	**620.4**	**576.8**	**606.4**	**576.2**	**575.3**	**582.9**
Quiet Aircraft Technology (QAT)	64.8	72.1	75.7	26.0	-	-
21st Century Aircraft Technology (TCAT)	66.6	-	-	-	-	-
Flight Research	86.4	-	-	-	-	-
Advanced Vehicle Concepts	31.9	-	-	-	-	-
Breakthrough Vehicle Technologies	122.6	-	-	-	-	-
Ultra-Efficient Engine Technology (UEET)	91.9	88.2	91.2	88.3	89.0	88.0
Propulsion & Power	147.5	-	-	-	-	-
Low Emissions Alternative Power - LEAP or LEAP 2x	-	120.9	128.4	115.4	116.1	118.6
Efficient Aerodynamic Shapes and Integration - EASI	-	68.0	85.5	74.4	74.0	74.9
Integrated Tailored Aerostructures - ITAS	-	71.4	70.1	69.9	69.3	71.1
Autonomous Robust Avionics - AuRA or AuRA 10x	-	20.4	19.8	19.3	19.2	19.6
Flight and System Demonstrations	8.7	112.9	113.1	115.7	115.3	114.9
Strategic Vehicle Architectures	-	22.9	22.6	22.9	22.9	24.9
4X Noise Reduction	-	-	-	44.3	69.5	70.9
Airspace Systems Program	**233.9**	**154.4**	**175.2**	**183.6**	**176.7**	**179.8**
Advanced Air Transportation Technology (AATT)	104.9	-	-	-	-	-
Small Aircraft Transportation System (SATS)	31.5	16.6	4.1	-	-	-
Virtual Airspace Modeling & Simulation (VAMS)	33.1	29.9	31.8	30.8	-	-
Efficient Aircraft Spacing	14.8	35.4	37.1	38.2	42.0	44.1
Efficient Flight Path Management	1.5	14.0	21.0	25.0	31.2	31.2
Strategic Airspace Usage	0.5	7.1	21.2	21.9	28.4	28.4
Space-Based Technologies	7.2	18.6	25.6	32.4	38.9	38.9
Human Measures and Performance	20.5	18.1	19.6	19.5	19.5	19.5
Technical Integration	19.9	14.7	14.8	15.8	16.7	17.7

* FY04 column includes FY 2004 Conference Report changes

FY 06 Proposed Augmentations

- Transforming the NAS
- HALE ROA Technologies and Operations
- Next Generation Clean Aircraft Power
- Aviation Security for ATS
- Quiet, Safe Rotorcraft
- Aviation Accident Reconstruction
- Research & Technology Test & Evaluation Environment
- Overland Supersonic Cruise Demonstrator
- Hypersonics

Augmentation Proposal Selection Process

- Executive Board (EB) made initial selection based on proposal synopses received from Centers
- Updated packages undergoing Peer Review
- Based on Peer Review feedback, EB will select proposals for continued planning
- Final EB down selection will occur in mid-March and resultant proposals will be submitted for Agency review April 1st
- Final Agency decisions scheduled for end of May

Transforming the NAS

- Objective
  - Provide the technology necessary to:
    - Support the national effort to transform the air transportation system
    - Develop core component technologies critical to the system of the future
    - Transition technologies to evolve from today's system to the transformed system
- Benefits
  - Development of the technology vital to the continued modernization of the NAS toward a high-performing system of the future for
    - Increased Capacity
    - Increased Efficiency
    - Seamless Integration of security and safety constraints

Transforming the NAS Deliverables

- Deliverables are dependent on National Plan being developed by the Joint Planning and Development Office (JPDO) for the Next Generation Air Transportation System. Currently under consideration:
  - Integrated architecture for information, communication, navigation, and surveillance, bread boarding subsystems and demonstrations
  - Computer codes of atmospheric physics extending the prediction capability and prototypes of tools for system operators (pilots, controllers, and dispatchers) that provide actionable information regarding the impact of weather
  - SWIM architectures, bread boarding systems, and demonstrations
  - Clear definition of the concepts, development of the high-risk requirements, development of technology solutions, and demonstrations

$,M	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
In-guide	148.1	172.1	189.0	176.0	176.0	
Augmentation Request		99.0	111.0	110.0	128.0	129.0
Total	148.1	271.1	300.0	286.0	304.0	305.0

HALE ROA Technologies and Operations

- Objectives:
  - Develop HALE Remotely Operated Aircraft (ROA) technologies and integrated capabilities that enable high value science missions, and open the door to low cost, extreme duration, stratospheric flight.
  - Accelerate HALE ROA technology maturation and transfer of technology from the Code R field Centers to scientific, civil and commercial partners
  - Collaborate with the DoD and DHS on the development and demonstration of dual use HALE ROA technologies
  - Facilitate continued US leadership in the emerging civil and commercial UAV markets
- Benefits
  - Enhanced national security by improving border patrol and coastal surveillance capabilities and FEMA rapid response capabilities to natural and man-made disasters
  - Improved weather forecasts, hurricane landfall predictions, and long term climate predictions by enabling in-situ and sustained vertical profile measurements over oceanic and polar regions
  - Enable exponential growth in the commercial UAV market by resolving the primary barriers in terms safe, routine and affordable access to civil airports and the national airspace system

HALE ROA Technologies and Operations

Deliverables

- Complete the additional steps required for “file & fly” access to civil airports and the National Airspace System (NAS) above 18,000 feet
  - Routine operations above FL 180 through Class C, D and E airspace; and establishing a Special Airworthiness Certification for the HALE class ROA
  - Routine operations above FL 180 through Class C, D and E airspace with emergency transitions to ROA airports
- Accelerate the completion of the following HALE ROA performance
  - Accelerate by 2 years (2007) capability for continuous track and loiter operations for up to 14 days with 200 kg payload at an altitude greater than 60,000 feet
  - Accelerate by 3 years)2009) capability up to loiter autonomously and continuous for up to 6 months with 150 kg payload at an altitude greater than 60,000 feet
- Develop and flight validate the additional capabilities:
  - Enable safe HALE ROA penetration of, and persistence within, severe storms over the oceans and CONUS
  - Enable HALE ROA mothership/daughtership operations

$,M	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
In-guide	44.0	43.2	40.2	50.0	40.0	40.0
Augmentation Request		55.0	80.0	95.0	100.0	90.0
Total	44.0	98.2	120.2	145.0	140.0	130.0

Next Generation Clean Aircraft Power

- Objective
  - Develop and demonstrate emerging fuel cell technologies for near term aircraft applications and establish a foundation for the next generation, revolutionary aircraft
    - Mature and demonstrate high power density (10x Current State of the Art) solid oxide fuel cell (SOFC) technologies and SOFC-turbine hybrid systems
    - Demonstrate the performance, durability, and fuel flexibility (hydrocarbon based aviation fuel and hydrogen) benefits of SOFCs for both primary and secondary power system applications
    - Determine feasibility of a zero harmless emission, ultra quiet commercial transport, the ultimate goal of fuel cells for commercial aviation;
- Benefits
  - More efficient, longer life power systems, enhancing both science and military mission performance
    - Fuel cell systems enable long and ultra long endurance missions
    - Fuel cell based payload power for Earth Science missions enhances instrumentation, data scanning, and data transfer
    - Fuel cell based emergency power improves survivability of military UAVs by extending engine out flight time

Next Generation Clean Aircraft Power

Deliverables

- Demonstrate Integrated Hybrid (fuel cell & turbine) System operations and durability achieving high efficiency (>2x current gas turbine approach) using aviation fuel by the end of FY2011
  - Validate high capability (5x DOE SECA 2010 specific power goal), long life SOFC stack
  - Validate compact, lightweight, and efficient fuel processing (reforming & desulfurization) for standard aviation fuels
- Conduct small scale demonstrations to mitigate risk and provide opportunities to apply the technology to enhance Earth Science and military UAV mission capabilities by the end of FY 2008
- Assess technology options for future zero emissions, all electric aircraft

$,M	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
In-guide						
Augmentation Request		27.0	49.0	53.0	54.0	50.0
Total		27.0	49.0	53.0	54.0	50.0

Aviation Security for ATS

- Objectives
  - Develop decision support technologies to provide enhanced security functions and multi-agency airspace security collaboration
  - Improve global threat understanding with multisource (ground / vehicle / ATM) data integration and probabilistic assessment tools.
  - Develop concepts for sample collection and detection of biological and chemical agents in airport environments
  - Develop capabilities and practices for providing comprehensive system surveillance and tamper-/hacker-proof ATS communications
  - Develop flight systems to decrease vulnerability of aircraft and on-board systems to security threats due to electronic and information warfare, and demonstrate flight systems to mitigate ManPADS attacks
- Benefit
  - Increase the robustness of the entire Air Traffic System against threats and hostile acts; and identify and inform users of potential vulnerabilities

Aviation Security for ATS

Deliverables (cont.)

- End-to-end fast-time simulation model of security aspects of operation of the NAS
- Operational field demonstration of enhanced rogue aircraft detection and response
- Field demonstration of knowledge discovery tools for cargo screening
- Demonstration of alertness-management training for security personnel and automated alertness monitoring in a relevant environment
- Human/system integration tools and models for understanding decision making and support tools to enhance performance in sensor-based screening systems.
- Demonstration of sensor concepts: biological sample collection in an airport environment; reliable alarm system for detecting chemical vapors
- System-wide NAS information security technologies to support information integrity and security for legal users and prevent denial-of-service
- Flight demonstration of controls and process for an in-flight recovery following a ManPADS attack, an electromagnetic interference attack, or rogue pilot takeover
- Demonstrate vulnerability and risk assessment tools for operational needs

$,M	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
In-guide (AvSSP)	188.0	175.1	178.0	173.7	179.2	179.2
Augmentation Request		85.0	95.0	85.0	75.0	75.0
Total	188.0	260.1	273.0	258.7	254.2	254.2

Quiet, Safe Rotorcraft

- Objectives:
  - Develop technologies that, when applied to new or existing rotorcraft, will enable pilots to operate them with significantly less danger, resulting in an accident rate equivalent to or better than other classes of aircraft
  - Develop technologies that will improve the mechanical safety, reliability, and maintainability of new rotorcraft including tilt-rotors and any other rotor-borne concepts
  - Develop approaches to technologies that will reduce the noise emitted by a rotorcraft, including its engine, the rotor itself, and other sources, to levels imperceptible at a distance and unobjectionable at close range
  - Develop approaches that reduce drive system source noise and significantly lower cabin noise to levels commensurate with current business jets

- Benefits
  - Enable exponential growth in the commercial rotorcraft market and consequently enhanced public mobility by resolving the primary barriers to public acceptance in terms of noise and safety
  - Enable DoD partners to extend these developments to applications that enhance national security, including homeland security

Quiet, Safe Rotorcraft

Deliverables

- Decrease Accident Rate
  - Training Procedures and Tools
  - Pre-flight and In-flight Decision Aids
  - High situation-awareness Cockpit Technologies
  - Drive System Prognostics / Diagnostics
  - Affordable Stability Augmentation System
- Reduce Noise
  - Maneuver noise prediction toolset
  - Low noise approach profiles
  - Quiet rotorcraft transmission
  - Active rotor control for reduced noise & vibration

$,M	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
In-guide	15.0	15.0	15.0	15.0	15.0	15.0
Augmentation Request		31.0	37.0	46.0	47.0	46.0
Total	15.0	46.0	52.0	61.0	62.0	61.0

Aviation Accident Reconstruction

- Objectives
  - Establish the capability to rapidly and accurately analyze aviation accidents by integrating NASA's premier flight simulation assets, advanced flight dynamics mathematical models, and newly developed human performance models
  - Develop a quick-response capability for accident investigations
  - Mitigate errors in today's training simulators

- Benefit
  - Promote the safety of the nation's air transportation system through rapid acquisition of knowledge pertinent to accident causal factors

Aviation Accident Reconstruction

Deliverables

- Quick response simulation capability for accident investigation support
- Model-based simulation and visualization tools to aid analysts in the interpretation of available data to infer what pilots may have known, intended or done at the time of the accident.
- Accident recreation tools to test the potential impacts of candidate solutions
- Validated training simulations models for immediate airline application
- A large set of turn-key simulation models for broad-based research applications

$,M	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
In-guide						
Augmentation Request		14.3	19.2	24.0	24.2	16.5
Total		14.3	19.2	24.0	24.2	16.5

Research & Technology Test & Evaluation Environment

- Objectives
  - Develop the research and technology to meet the test and evaluation environment of the future

- Benefits
  - Ensure that the necessary test and evaluation environment for future aeronautics systems is available that provides an effective balance among analysis, simulation, ground testing, and flight testing

Research & Technology Test & Evaluation Environment

Deliverables

- Establish requirements and the capabilities need to meet the requirements based on an assessment of future needs Accelerate the completion of the following HALE ROA performance
- Assess current capability and capability resulting from ongoing research
- Identify gaps in current capability
- Develop research and technology plans to meet capability

$,M	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
In-guide						
Augmentation Request		TBD	TBD	TBD	TBD	TBD
Total						

Overland Supersonic Cruise Demonstrator

- Objective
  - Integrated demonstration at full scale of key technologies for sustained supersonic cruise flight
  - Creation of a new flight research platform for future sustained supersonic cruise technology exploration and demonstration Benefits - More efficient, longer life power systems, enhancing both science and military mission performance
- Benefit
  - Enable the U.S. aviation industry to pursue development of a new class of efficient, economic and environmentally acceptable supersonic cruise aircraft for civil and military applications.
  - The OSCD will become a new national capability to support the validation of future technology developments for sustained supersonic cruise

Overland Supersonic Cruise Demonstrator

Deliverables

- Overland Supersonic Cruise Demonstrator
- Flight demonstration of a set of technologies
  - Sonic boom mitigation
  - Inlet design and integration for low noise
  - Supersonic laminar flow
  - Propulsion – airframe integration
  - Computational design
  - Aerodynamic and propulsion controls

$,M	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
In-guide						
Augmentation Request	5.0	47.0	92.0	156.0	100.0	32.0
Total	5.0	47.0	92.0	156.0	100.0	32.0

Hypersonics

- Hypersonics work is funded in the Next Generation Launch Technology Program
  - Program eliminated in FY 05 budget
  - Funding transferred to the Exploration Enterprise
    - Hypersonics not in Exploration portfolio
- Enterprise desire to maintain a program in Hypersonics
  - Build on X-43A experience
  - Maintain core competencies
  - Continue cooperative effort with DoD
- Augmentation proposal being developed

Augmentation Outlook for FY 06

- Aeronautics has good support in the Agency and Administration
- Providing significant augmentations to the aeronautics budget will be challenging
  - Reducing the deficit is an Administration priority